SECTION 650
OPEN-GRADED ASPHALT FRICTION COURSE, TYPES FC-1, FC-1 MODIFIED AND FC-2 MODIFIED

650-1 DESCRIPTION

Perform the work covered by this section including, but not limited to, construction of a plant mixed open-graded asphalt friction course (OGAFC) properly laid upon a prepared surface in accordance with these Specifications and in conformity with the lines, grades, thickness and typical sections shown on the plans; producing, weighing, transporting, placing and rolling the plant mix as specified in Section 610; furnishing the asphalt binder, anti-strip additive, fiber stabilizing additive and all other materials for the plant mix; furnishing and applying tack coat as specified; providing QC as specified in Section 609 as modified for OGAFC; surface testing of the completed pavement; furnishing scales; making any repairs or corrections to the friction course that may become necessary and maintaining the friction course until final acceptance of the project.

650-2 MATERIALS

Refer to Division 10.

Item	Section
Anti-strip Additives	1012-1(G)
Asphalt Binder, Grade PG 64-22, PG 76-22	1020-2
Coarse Aggregate	1012-1(B)
Fiber Stabilizing Additives	1012-1(I)
Fine Aggregate	1012-1(C)
Mineral Filler	1012-1(D)
Reclaimed Asphalt Shingles (RAS)	1012-1(F)

650-3 COMPOSITION OF MIXTURE (MIX DESIGN AND JOB MIX FORMULA)

(A) General

Design the open-graded asphalt friction course using a mixture of coarse and fine aggregate, asphalt binder, mineral filler, fiber stabilizing additive and other additives as required to produce a mix meeting Table 650-1.

Submit in writing a mix design and proposed JMF targets for each required mix type and combination of aggregates to the Engineer for review and approval at least 20 days before start of asphalt mix production. The mix design shall be prepared by a mix design technician approved by the Department in an approved mix design laboratory. Perform the mix design in accordance with Article 610-3 and the Department's mix design procedures. Copies of these procedures can be obtained through the Materials and Tests Unit. Submit the mix design and proposed JMF targets on forms and in a format approved by the Department.

The mix design and JMF target values will be established within the mix design criteria specified in Table 650-1 for the particular type of mixture to be produced. The formula for each mixture will indicate the blend percentage of each aggregate fraction to be used, a single percentage of combined aggregate passing each required sieve, the percentage and grade of asphalt binder (by weight of total mixture) to be incorporated into the mixture, the percentage of anti-strip additive to be added to the asphalt binder, the percentage of fiber stabilizing additive (by weight of total mix) and the temperature at which the mixture is to be discharged from the plant.

Have on hand at the asphalt plant the approved mix design and JMF issued by the Department, before beginning the work.

The JMF for each mixture shall remain in effect until modified in writing, provided the results of tests performed on material currently being produced conform with specification requirements.

If a change in sources of aggregate materials needs to be made, a new mix design and JMF will be required before the new mixture is produced.

When unsatisfactory results or other conditions make it necessary, the Engineer may establish a new JMF.

(B) Mix Design Criteria

Design open-graded asphalt friction course (OGAFC) mixtures conforming to the gradation requirements and other mix design criteria in Table 650-1 for the mix type specified.

Use the asphalt binder grade shown in Table 650-1 for the mix type specified. RAS may be used in accordance with Subarticle 610-3(A).

Use an anti-strip additive in all OGAFC mixes. It may be hydrated lime or a chemical additive or both. Add chemical anti-strip additive at a rate of 0.5% by weight of asphalt binder. Add hydrated lime at a rate of 1.0% by weight of dry aggregate. Use an approved source and grade.

If needed to prevent asphalt draindown, incorporate a fiber stabilizing additive into all OGAFC types. Add the fiber at a dosage rate by weight of the total mix as approved.

When requested, submit to the Materials and Tests Unit in Raleigh, samples of mix components. Submit sample sizes as noted below or as requested. Provide the samples at least 20 days before the anticipated beginning placement of OGAFC mixture.

250 lb of each coarse aggregate
150 lb of each fine aggregate
1 gal. of mineral filler and/or baghouse fines
1 gal. of hydrated lime OR 1 pint of chemical anti-strip additive
4 lb of fiber stabilizing additive (if used)

Aggregate samples when combined according to the Contractor's proposed aggregate blend percentages shall be within the gradation range defined by the target values of Table 650-1 for each sieve or the samples will not be representative.

The mixing temperature at the asphalt plant will be established on the JMF.

Add the anti-strip additive to the asphalt binder in accordance with Article 620-3.

TABLE 650-1
OGAFC GRADATION CRITERIA

Grading Requirements	**Total Percent Passing**		
Sieve Size (mm)	*Type FC-1*	*Type FC-1 Modified*	*Type FC-2 Modified*
19.0	-	-	100
12.5	100	100	85 - 100
9.50	75 - 100	75 - 100	55 - 75
4.75	25 - 45	25 - 45	15 - 25
2.36	5 - 15	5 - 15	5 - 10
0.075	1.0 - 3.0	1.0 - 3.0	2.0 - 4.0

TABLE 650-2 OGAFC MIX DESIGN CRITERIA			
Property	**Design Parameters**		
Asphalt Binder Grade	PG 64-22	PG 76-22	PG 76-22
Asphalt Binder, % Range	5.0 - 8.0	5.0 - 8.0	5.0 - 8.0
Mixing Temperature Range Established by Engineer	200 - 275°F	300 - 350°F	300 - 350°F
Draindown,%, AASHTO T 305	0.3 max.	0.3 max.	0.3 max.

650-4 PLANT EQUIPMENT

Use plant equipment in accordance with Article 610-5 and the requirements herein.

When fiber stabilizing additives are used as an ingredient of the mixture, use a separate feed system capable of accurately proportioning the required quantity into the mixture and in such a manner that uniform distribution will be obtained. Interlock the proportioning device with the aggregate feed or weigh system so as to maintain the correct proportions for all rates of production and batch sizes. Accurately control the proportion of fibers to within ± 10% of the amount required. Provide flow indicators or sensing devices for the fiber system that are interlocked with plant controls such that mixture production will be interrupted if introduction of the fiber fails.

When a batch type plant is used, add the fiber to the aggregate in the weigh hopper or as approved. Increase the batch dry mixing time by 8 to 12 seconds, or as directed, to assure the fibers are uniformly distributed before the injection of asphalt binder into the mixer.

When a continuous mix or dryer-drum type plant is used, add the fiber to the aggregate and uniformly disperse at the point of injection of asphalt binder. Add the fiber in such a manner that it will not become entrained in the exhaust system of the drier or plant.

650-5 CONSTRUCTION METHODS

Produce, transport to the site and place the OGAFC in accordance with Section 610, except as otherwise provided below.

Do not place OGAFC between October 31 and April 1 of the next year, unless otherwise approved. Place friction course, Type FC-1 mixes, only when the road surface temperature is 50°F or higher and the air temperature measured in the shade away from artificial heat is 50°F or higher. The minimum air and road surface temperature for placing Type FC-1 Modified and FC-2 Modified mixes will be 60°F.

Before starting production of the mix, stockpile all aggregates for a sufficient period of time to facilitate the drainage of free moisture.

Add the anti-strip additive to the asphalt binder in accordance with Article 620-3.

Clean the existing surface in an acceptable manner before placement of any asphalt material.

Remove all existing raised pavement markers as directed and repair any damaged areas caused by the removal. Use an approved dense graded mixture of similar type material for the repair.

Apply tack coat in accordance with Section 605 and the following

(A) Use Asphalt Binder, Grade PG 64-22 tack coat material or as approved.

(B) Uniformly apply the tack coat material at a rate of application 0.06 to 0.08 gal/sy, as directed.

Spread and finish the friction course as specified in Article 610-8. Roll the friction course as specified in Article 610-9.

Perform this work in accordance with and using equipment meeting Section 9.5 of the *HMA/QMS Manual.*

Use a Material Transfer Vehicle (MTV) when placing all types of OGAFC. Use a MTV meeting Section 9.5(E) of the *HMA/QMS Manual.*

Remove and replace any part of the finished friction course that shows non-uniform distribution of asphalt binder, aggregate or fiber at no additional cost to the Department.

Coordinate plant production, transportation and paving operations such that uniform continuity of operation is maintained. If spreading operations are interrupted, the Engineer may require that a transverse joint be constructed any time the mixture immediately behind the paver screed cools to less than 250ºF.

When OGAFC, Type FC-2 Modified mixture is specified, use OGAFC, Type FC-1 Modified on entrance and exit ramps, gore areas and at end of project construction joints. Adjust the thickness of placement as specified below.

For end of project joints, provide a transition area consisting of one load of mixture per lane, or as directed. Taper the mixture in thickness from 3/8" at the end of the project to the typical thickness (approximately 3/4") within the maximum distance of spread for one load of mixture. For ramps and gore areas, taper the mixture in thickness from that at the edge of the mainline, approximately 3/4" to 3/8" at the point of the ramp transverse joint. Construct the ramp transverse joint at a point specified by the plans or as directed.

650-6 QUALITY MANAGEMENT SYSTEM

Produce the OGAFC in accordance with Section 609.

650-7 MEASUREMENT AND PAYMENT

Open-Graded Asphalt Friction Course, Type FC-1, Type FC-1 Modified or *Type FC-2 Modified* will be measured and paid as the actual number of tons of friction course incorporated into the completed and accepted work. The friction course will be measured by being weighed in trucks on certified platform scales or other certified weighing devices.

Furnishing asphalt binder for the mix will be paid as provided in Article 620-4 for *Asphalt Binder for Plant Mix*. Adjustments in contract unit price due to asphalt binder price fluctuation will be made in accordance with Section 620.

No direct payment will be made for providing and using the materials transfer vehicle or any associated equipment, as the cost of providing same shall be included in the contract unit bid price per ton for the mix type to be placed.

Payment will be made under:

Pay Item	Pay Unit
Open-Graded Asphalt Friction Course, Type FC-1	Ton
Open-Graded Asphalt Friction Course, Type FC-1 Modified	Ton
Open-Graded Asphalt Friction Course, Type FC-2 Modified	Ton